

IV. Remarks

Claims 2 and 4 - 22 are pending in the application. Claims 2 and 4 are amended. Former claims 1 and 3 are respectively replaced by new claims 5 and 6. Claims 7 - 22 directed to melt blends and methods are added. The specification and claims have been amended to more particularly point out and distinctly claim the subject matter of the invention.

With regard to the various bases of the **DETAILED ACTION**, applicant responds:

A. Claim Rejections - 35 U.S.C. § 112

Claim 3, rewritten as new claim 6, particularly points out the steps in selecting materials to produce a melt blended composition having properties that are specified in advance of the blending process and determining their respective proportions. The remaining claims are drafted to specify formulae components, proportions and characteristics.

B. Claim Rejections - 35 U.S.C. § 102

The rejection of Claims 1 - 4 under 35 U.S.C. 102(b) based on Cheruvu et al., (US 6,194,520) should be withdrawn.

[Corresponding pending claims 2, 4, 5 and 6]

Cheruvu et al., (US 6,194,520) describe a specialized copolymer resin that is a blended ethylene reactor powder, a virgin material that has no processing history as a polymer. In the context of the claimed subject matter, the material of Cheruvu et al.

is a specialty blow-molding grade of high density polyethylene. According to paragraph [0004] of the Specification:

Typically, corrugated polyethylene pipe manufacturers utilize specialty blow-molding grades of high-density polyethylene having a bimodal or multi-modal molecular weight distributions.... The disadvantage of this approach is that the pipe manufacturer typically pays a premium for as polymerized virgin corrugated pipe grade high-density polyethylene and can not easily modify the physical properties of the blend composition to enhance the polyethylene and can not easily modify the physical properties of the polyethylene composition to enhance the physical properties or processability in relation to the pipe size and profile shape. Ideally, the corrugated pipe manufacturers would prefer to purchase lower cost off specification, wide specification, reprocessed and recycled polyethylene components that they blend to meet the appropriate AASHTO standards.

See also paragraphs [0026], [0031], [0032], [0047] and [0053] - [0055].

The subject matter of claim 5¹ is a melt blend comprising a high molecular weight (HMW) previously melted and solidified high density polyethylene (HDPE) component, a previously melted and solidified low molecular weight (LMW) HDPE homopolymer, and a previously melted and solidified LMW HDPE copolymer in a ratio of each component determined by a formula. According to the Specification:

[The invention provides to] corrugated HDPE pipe and fittings manufacturers, the opportunity to vary the blend ratios of virgin, recycled, off specification, wide specification, reprocessed and regrind HMW and low molecular weight HDPE's to obtain the required combination of physical and process properties of pipe and fittings. For example the pipe manufacturer may vary blend ratios to enhance 24-hour impact behavior of the pipe, ESCR and flexural stiffness by specific pipe diameter and corrugation design.

....

¹ References to designated claims in the text and in parentheses are intended to be exemplary rather than inclusive.

[The] invention provides the benefit of blending recycled, reprocessed, wide and off specification and virgin HDPE's to provide corrugated HDPE pipe and fittings material compositions having enhanced physical properties and processing characteristics capable of meeting and exceeding AASHTO standards.

.... The blend may include virgin, reprocessed, wide specification, flake or regrind HMW homopolymer and copolymer HDPE (5 to <50 %) as a minor component and HMW HDPE (>50 to 95%) as a major component.

Specification: paragraphs [0009], [0010] and [0022].

The Specification also relates the advantages of the claimed melt blend compositions and the method for selecting *a priori* HMW and LMW HDPE components for melt blending to produce a composition having desirable properties.

At paragraph [0032] the Specification discusses an example:

A further embodiment utilizes HMW HDPE major component 20 (Figure 8) having a bimodal molecular weight distribution (MWD). Such HDPE is available as a commodity in the form of industrial and merchandise bag film grade high-density polyethylene, e.g., Exxon Mobil 7760. The HMW HDPE major component wherein the MWD of each peak is narrow and the peaks are spaced sufficiently far apart provide an overall broad MWD. The HMW bimodal film grade high-density polyethylene, typically, has a density of 0.949 to 0.955 grams per cubic inch and MI values of 0.01 to 1.0 grams per 10 minutes. The narrow MWD peaks, spread far apart eliminate the very long and the very short molecular species associated with unimodal polyethylene having the same weight average molecular weight. Environmental stress crack resistance of the bimodal HMW HDPE component 14 (Figure 7) is increased as compared to the unimodal HMW HDPE component 12 (Figure 6) having similar MI. A mixture of low molecular weight HDPE homopolymer and copolymer components is utilized to enhance the processability and the physical properties of the resulting polyethylene composition. A mixture of narrow MWD injection molding grades of HDPE homopolymer, e.g., Equistar M 6580 and HDPE copolymer, e.g., Equistar M 5370 provide the low molecular weight (LMW) HDPE. The mixture 13 of LMW HDPE homopolymer and copolymer is shown in Figure 6. The bulk of commercially available

injection molding grade copolymers have a density of about 0.950 to about 0.957 grams per cubic centimeter and injection grade homopolymers a density of about 0.958 to about 0.968 grams per cubic centimeter and both having MI from about 1 to about 100 grams per 10 minutes. Density and MI of the polyethylene composition can be varied independently by adjusting the ratio of the relative amounts of LMW HDPE homopolymer and copolymer and the ratio of the relative amount of the mixture of the LMW HDPE homopolymer and copolymer to amount of the HMW HDPE.

In the foregoing example, HMW HDPE are selected from a class of film or extrusion resins and LMW homopolymer and copolymer are selected from a class of injection molding grades of HDPE resins. The resins are previously melted and solidified HDPE resins distinguishable over powders made from the reactor process described in Cheruvu, *et al.*

Cheruvu *et al.* do not address the blending goals, nor the consequent achievements -- in environmental impact and the utilization of recycled materials -- of the melt blends of previously melted and solidified resins as addressed in the specification and claims herein. The claimed invention utilizes large quantities of recycled plastics to produce an enhanced melt blend useful in performance applications. [See the PETITION TO MAKE SPECIAL filed in a continuation-in-part of the present application, Serial No. 10/194,136. (Copy attached.)]

At Col. 4, lines 54 - 57, Cheruvu *et al.* relate: "In preparing the ethylene polymer of this invention consisting essentially of HMW and LMW ethylene polymer components, such components may be prepared separately and physically blended in a conventional manner, e.g., by initially dry blending the resin in a mixer with suitable additives, and then melt blending it in an extruder." Cheruvu *et al.* engineer

a specialty bimodal resin of "polymerized ethylene", beginning with a gas phase tandem reactor polymerization process, which produces an "ethylene polymer blend" [Column 4, line 51 *et seq.*; Column 7, lines 50 - 59] from powders proximately resulting from the reactor polymerization of ethylene. The properties of the Cheruvu *et al.* reactor powder polymer are determined by feedstock, catalyst, chemical, polymerization, reaction, and other parameters.

In contrast, the claimed invention utilizes previously melted and solidified components already having a processing history as a polymer. (The pellets of the Cheruvu *et al.* bimodal material may indeed be a component of the melt blend claimed.) The polymer components of the claimed melt blend have a processing history as a solid; the ethylene feedstock and powders of Cheruvu *et al.* do not. The claimed melt blends reduce raw material cost and increase the use of recycled materials. The melt blends and processes claimed allow the selection *a priori* of previously melted and solidified materials in the proportions determined in do not disclose that previously melted and solidified components, selected in accordance with the mathematical parameters of the independent claims, produce a melt blend of desired enhanced properties. (Claims 13 - 17 and 21).

The subjects of claims 2 and 4 - 22 achieve properties of an engineered specialty resin beginning with previously melted and solidified HDPE, not ethylene. The HDPE can be virgin or wide or off specification material, or after market recycled, reprocessed, flake or regrind material. Cheruvu *et al.*, do not describe that by utilizing the melt blend proportions (Claims 5, 6, 9, 13, 19 and 20) and a component

selection process for previously melted and solidified resins, (*Id.*)², shapes (Claims 2 and 10) and corrugated HDPE pipe (Claim 4) having improved properties (Claims 16 and 17) determined *a priori*, before blending (Claims 6, 13, 21 and 22), can be formed from virgin, reprocessed, wide and off specification, recycled, flake and regrind HDPE (Claims 8, 12 and 18) that has been previously melted and solidified (Claims, *passim*). Applicant accordingly requests the rejection be withdrawn.

V. Conclusion

The Examiner's careful attention to this application is greatly appreciated and the Examiner's suggestions in clarifying the claims have been adopted.

In view of the foregoing restatement of the claims and the accompanying remarks, applicant submits that the rejections under 35 USC §§ 112 and 102 should be withdrawn and that this case be passed to issue.

Reexamination, reconsideration and allowance are respectfully requested.

Respectfully submitted,



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Enclosure: Petition to Make Special in Serial No. 10/194,136

² Claims 13, 14 and 15 relate to subject matter at Paragraphs 34 *et seq.* of the Specification.

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I hereby certify that this RESPONSE TO THE OFFICIAL COMMUNICATION MAILED ON APRIL 1, 2003 is being filed by facsimile to 703-872-9310, Attention Examiner Thao T. Tran, Group 1711, c/o Commissioner for Patents, Washington, D.C. 20231 on April 28, 2003.



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Application Number 10/017,314: Response to the Official Communication Mailed on April 1, 2003

Page 16 of 16 pages

COLUMBUS/1050398 v 02

Received from < > at 4/29/03 4:47:10 PM [Eastern Daylight Time]